

A Magnetic Thermometer for High-Resolution 10 mK Scale Thermometry, Phase I

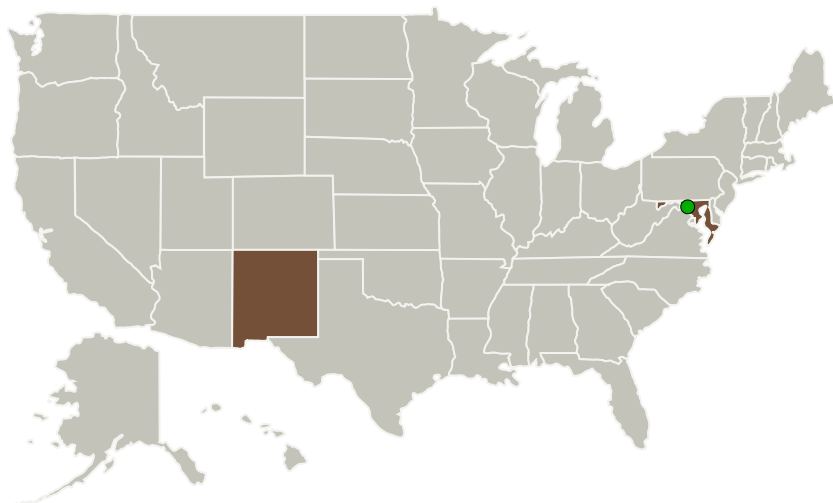
Completed Technology Project (2010 - 2010)



Project Introduction

An innovative thin-film magnetic thermometer with integrated superconducting quantum interference device (SQUID) readout is described for fast, precision temperature measurements in the 10 mK range. The compact thermometer consists of a miniature DC SQUID susceptometer with a dilute paramagnetic alloy deposited in one of the two series-configured gradiometric SQUID pickup loops that form the SQUID inductance. Directly sensing the magnetic signal with the SQUID eliminates losses that would otherwise occur by transformer-coupling the signal to a remotely located SQUID, usually operating at a higher temperature and consequently with a higher noise floor. In addition, a novel superconducting flux concentrator deposited on top of the paramagnetic alloy homogenizes and concentrates the magnetic flux density in the paramagnet and reduces the inductance of the pickup coil, both of which improve the sensitivity and signal to noise ratio as compared with previous miniature susceptometer designs. The innovative magnetic thermometer design is expected to achieve a temperature resolution well below $1 \mu\text{K}/\text{Hz}^{1/2}$.

Primary U.S. Work Locations and Key Partners



A Magnetic Thermometer for High-Resolution 10 mK Scale Thermometry, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

A Magnetic Thermometer for High-Resolution 10 mK Scale Thermometry, Phase I

Completed Technology Project (2010 - 2010)



Organizations Performing Work	Role	Type	Location
STAR Cryoelectronics, LLC	Lead Organization	Industry	Santa Fe, New Mexico
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	New Mexico

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138733>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

STAR Cryoelectronics, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

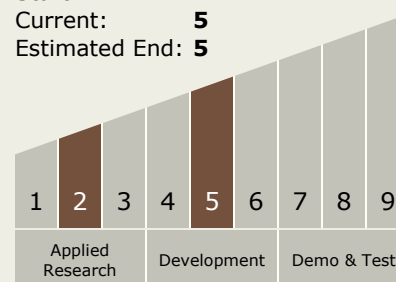
Carlos Torrez

Principal Investigator:

Robin H Cantor

Technology Maturity (TRL)

Start: 2
Current: 5
Estimated End: 5



A Magnetic Thermometer for High-Resolution 10 mK Scale Thermometry, Phase I

Completed Technology Project (2010 - 2010)



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System